



**Shredder Emissions Test Report for
Total Hydrocarbons, Particulate, and Metals
General Iron Industries, Inc. – Chicago, Illinois
IEPA Bureau of Air Site ID No.: 031600BTB**

JUNE 25, 2018

APPENDIX A –

**Report of VOC Emission Testing on the Shredder Exhaust at
the General Iron Facility Located in Chicago, Illinois**

Prepared by Stack Test Group, Inc.



Chicago Office:
1500 Boyce Memorial Dr.
Ottawa, IL 61350
Phone 815-433-0545
888 STACK TEST
Fax 815-433-0592

**REPORT OF VOC EMISSION TESTING ON THE SHREDDER EXHAUST AT THE
GENERAL IRON FACILITY LOCATED IN CHICAGO, ILLINOIS**

Prepared for:

FREEBORN & PETERS, LLC
311 SOUTH WACKER DRIVE
SUITE 3000
CHICAGO, IL 60606

Prepared by:

STACK TEST GROUP, INC.
1500 BOYCE MEMORIAL DRIVE
OTTAWA, IL 61350

MAY 25, 2018
STACK TEST GROUP, INC. PROJECT NO. 18-3042

Report Prepared By:

Bill J. Byczynski
Principal

Report Reviewed By:

Nicholas Sergenti QSTI
Project Manager

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1.0 EXECUTIVE SUMMARY

On May 25, 2018, The Stack Test Group, Inc. performed volatile organic compound (VOC) emission testing on the shredder exhaust at the General Iron facility located in Chicago, IL. Three one-hour tests were conducted on this source for the VOC emission testing. Presented below are the average results of these tests.

Shredder Exhaust Stack:

VOC Concentration:	240.4 PPM as Propane Uncorrected
VOC Concentration:	104.20 Pounds per Hour Uncorrected
VOC Concentration:	218.9 PPM as Propane Corrected*
VOC Concentration:	94.87 Pounds per Hour Corrected*

*VOC corrected refers to correcting for exempt compounds

2.0 INTRODUCTION

On May 25, 2018, The Stack Test Group, Inc. performed volatile organic compound (VOC) emission testing on the shredder exhaust at the General Iron facility located in Chicago, IL.

Testing was conducted while General Iron personnel operated the shredder and corresponding control equipment under normal conditions. A copy of the operating data is included.

Testing was conducted by Mr. Bill J. Byczynski, Mr. Nicholas Sergenti, Mr. Lee Kennedy and Mr. Benjamin Byczynski of the Stack Test Group, Inc. Testing was under the direction of Ms. Ann M. Zwick of Freeborn & Peters, LLC. Testing was witnessed by Mr. Kevin Mattison of the Illinois Environmental Protection Agency (IEPA) and Mr. Scott Connolly of the U.S. EPA.

A TO-15 sample was integrated simultaneously with the Method 25A testing. The samples were sent to the laboratory and analyzed for exempt VOC compounds per Method TO-15. A response factor was then developed on the FID used in this test series. The response factor for each compound was used in subtracting the exempt VOC compounds from the total VOC readings.

All testing followed the guidelines of U.S. EPA Reference Methods 1 through 4, 25A and TO-15. This report contains a summary of results for the above-mentioned tests and all the supporting field, process, and computer generated data.

At the beginning of the test series, the analyzer was calibrated and then checked for calibration error by introducing zero, low-range, mid-range and high-range calibration gases to the back of the analyzers. Before and after each individual test run, a system bias was performed by introducing a zero and mid-range propane calibration gas to the outlet of the probe. Calibration gases used were U.S. EPA Protocol 1 certified.

3.3.2 Sample Duration and Frequency

The Method 25A train samples were collected in triplicate with each test lasting sixty minutes in duration.

3.3.3 Calibrations

All sampling equipment was calibrated according to the procedures outlined in EPA Reference Method 25A. Copies of the FID calibrations are included in Appendix D.

4.0 TEST RESULTS

Presented in this section are the results of this test series. Test results are reported in Table 4.1. Table 4.1 reports the results for the shredder exhaust including stack gas temperature, percent carbon dioxide and oxygen, percent moisture, molecular weight of the stack gas dry and wet, velocity in feet per second (fps), and flow rate in actual cubic feet per minute (acfmin), standard cubic feet per minute (scfm), and dry standard cubic feet per minute (dscfm).

Tables 4.1 also presents the VOC results for the shredder exhaust. The VOC results are presented in terms of parts per million as propane uncorrected, ppm as propane corrected, pounds per standard cubic feet (lb/scf), and pounds per hour (lb/hr). The exempt VOC compounds are also listed in Table 4.1 in terms of ppm. The exempt VOC compounds are subtracted from the total VOC uncorrected ppm to obtain the corrected ppm.

Copies of the calculations used to determine these emission rates may be found in Appendix A. Copies of the field data sheets are presented in Appendix B. Copies of equipment calibrations are presented in Appendix D.

Table 4.1

VOC Results General Iron Chicago, IL 05/25/18 Shredder Exhaust					
Test No:	<u>T1</u>	<u>T2</u>	<u>T3</u>	<u>Avg.</u>	
Start Time:	08:35 AM	09:49 AM	11:05 AM		
Finish Time:	09:35 AM	10:48 AM	12:26 PM		
Stack Gas Temperature, °F:					
% Carbon Dioxide:	114.1	116.8	119.1	116.7	
% Oxygen:	0.2	0.2	0.1	0.2	
% Moisture:	20.5	20.5	20.7	20.6	
Molecular Weight dry, lb/lb-Mole:	4.10	3.77	3.86	3.91	
Molecular Weight wet, lb/lb-Mole:	28.85	28.85	28.84	28.85	
Velocity and Flow Results:					
Average Stack Gas Velocity FPS:	85.33	86.43	87.20	86.32	
Stack Gas Flow Rate, ACFM:	69,834	70,734	71,364	70,644	
Stack Gas Flow Rate, SCFM:	62,834	63,341	63,654	63,276	
Stack Gas Flow Rate, DSCF/HR:	3,615,492	3,657,182	3,671,800	3,648,158	
Stack Gas Flow Rate, DSCFM:	60,258	60,953	61,197	60,803	
VOC Results (Uncorrected):					
PPM as Propane:	281.0	169.9	270.3	240.4	
LBS/DSCF:	3.21E-05	1.94E-05	3.09E-05	2.75E-05	
LBS/HR (as Propane):	120.98	73.74	117.89	104.20	
VOC Results (Corrected):					
PPM as Propane:	268.8	146.6	241.4	218.9	
LBS/DSCF:	3.07E-05	1.67E-05	2.76E-05	2.50E-05	
LBS/HR (as Propane):	115.72	63.61	105.27	94.87	

APPENDIX A
SAMPLE CALCULATIONS

SAMPLE CALCULATIONS

The tables presenting the results are generated electronically from raw data. It may not be possible to exactly duplicate these results using a calculator. The reference method data, results and all calculations are carried to sixteen decimal places throughout. The final table is formatted to an appropriate number of significant figures.

1. Volume of water collected (wscf)

$$V_{wstd} = (0.04707)(V_{lc})$$

Where:

V_{lc} total volume of liquid collected in impingers and silica gel (ml)

V_{wstd} volume of water collected at standard conditions (ft^3)

0.04707 conversion factor (ft^3/ml)

2. Volume of gas metered, standard conditions (dscf)

$$V_{mstd} = \frac{(17.64)(V_m) \left(P_{bar} + \frac{\Delta H}{13.6} \right) (Y_d)}{(460 + T_m)}$$

Where:

P_{bar} barometric pressure (in. Hg)

T_m average dry gas meter temperature ($^{\circ}\text{F}$)

V_m volume of gas sample through the dry gas meter at meter conditions (ft^3)

V_{mstd} volume of gas sample through the dry gas meter at standard conditions (ft^3)

Y_d gas meter correction factor (dimensionless)

ΔH average pressure drop across meter box orifice (in. H_2O)

17.64 conversion factor ($^{\circ}\text{R}/\text{in. Hg}$)

13.6 conversion factor (in. $\text{H}_2\text{O}/\text{in. Hg}$)

460 $^{\circ}\text{F}$ to $^{\circ}\text{R}$ conversion constant

SAMPLE CALCULATIONS (CONTINUED)

3. Volume of gas metered, standard conditions (dscm)

$$V_{mstd(m)} = \frac{(V_{mstd(ft)})}{35.35}$$

Where:

$V_{mstd(ft)}$	volume of gas sample through the dry gas meter at standard conditions (ft^3)
$V_{mstd(m)}$	volume of gas sample through the dry gas meter at standard conditions (m^3)
35.35	conversion factor (ft^3 to m^3)
13.6	conversion factor (in. H ₂ O/in. Hg)

4. Sample gas pressure (in. Hg)

$$P_s = P_{bar} + \left(\frac{P_g}{13.6} \right)$$

Where:

P_{bar}	barometric pressure (in. Hg)
P_g	sample gas static pressure (in. H ₂ O)
P_s	absolute sample gas pressure (in. Hg)
13.6	conversion factor (in. H ₂ O/in. Hg)

5. Actual vapor pressure (in. Hg)¹

$$P_v = P_s$$

Where:

P_v	vapor pressure, actual (in. Hg)
P_s	absolute sample gas pressure (in. Hg)

6. Moisture content (%)

$$B_{wo} = \frac{V_{wstd}}{V_{mstd} + V_{wstd}}$$

Where:

B_{wo}	proportion of water vapor in the gas stream by volume (%)
V_{mstd}	volume of gas sample through the dry gas meter at standard conditions (ft^3)
V_{wstd}	volume of water collected at standard conditions (ft^3)

¹ For effluent gas temperatures over 212°F, P_v is assumed to be equal to P_s .

SAMPLE CALCULATIONS (CONTINUED)

7. Saturated moisture content (%)

$$B_{ws} = \frac{(P_v)}{(P_s)}$$

Where:

B_{ws}	proportion of water vapor in the gas stream by volume at saturated conditions (%)
P_s	absolute sample gas pressure (in. Hg)
P_v	vapor pressure, actual (in. Hg)

Whichever moisture value is smaller is used for B_{wo} in the following calculations.

8. Molecular weight of dry gas stream (lb/lb·mole)

$$M_d = M_{CO_2} \frac{(CO_2)}{(100)} + M_{O_2} \frac{(O_2)}{(100)} + M_{CO+N_2} \frac{(CO + N_2)}{(100)}$$

Where:

M_d	dry molecular weight of sample gas (lb/lb·mole)
M_{CO_2}	molecular weight of carbon dioxide (lb/lb·mole)
M_{O_2}	molecular weight of oxygen (lb/lb·mole)
M_{CO+N_2}	molecular weight of carbon monoxide and nitrogen (lb/lb·mole)
CO_2	proportion of carbon dioxide in the gas stream by volume (%)
O_2	proportion of oxygen in the gas stream by volume (%)
$CO+N_2$	proportion of carbon monoxide and nitrogen in the gas stream by volume (%)
100	conversion factor (%)

9. Molecular weight of sample gas (lb/lb·mole)

$$M_s = (M_d)(1 - B_{wo}) + (M_{H_2O})(B_{wo})$$

Where:

B_{wo}	proportion of water vapor in the gas stream by volume
M_d	dry molecular weight of sample gas (lb/lb·mole)
M_{H_2O}	molecular weight of water (lb/lb·mole)
M_s	molecular weight of sample gas, wet basis (lb/lb·mole)

SAMPLE CALCULATIONS (CONTINUED)

10. Velocity of sample gas (ft/sec)

$$V_s = \left(K_p \right) \left(C_p \right) \left(\sqrt{\Delta P} \right) \left(\sqrt{\frac{(T_s + 460)}{(M_s)(P_s)}} \right)$$

Where:

K_p	velocity pressure coefficient (dimensionless)
C_p	pitot tube constant
M_s	molecular weight of sample gas, wet basis (lb/lb·mole)
P_s	absolute sample gas pressure (in. Hg)
T_s	average sample gas temperature (°F)
V_s	sample gas velocity (ft/sec)
$\sqrt{\Delta P}$	average square roots of velocity heads of sample gas (in. H ₂ O)
460	°F to °R conversion constant

11. Total flow of sample gas (acf m)

$$Q_a = (60)(A_s)(V_s)$$

Where:

A_s	cross sectional area of sampling location (ft ²)
Q_a	volumetric flow rate at actual conditions (acf m)
V_s	sample gas velocity (ft/sec)
60	conversion factor (sec/min)

12. Total flow of sample gas (dscfm)

$$Q_{std} = \frac{(Q_a)(P_s)(17.64)(1 - B_{wo})}{(T_s + 460)}$$

Where:

B_{wo}	proportion of water vapor in the gas stream by volume
P_s	absolute sample gas pressure (in. Hg)
Q_a	volumetric flow rate at actual conditions (acf m)
Q_{std}	volumetric flow rate at standard conditions, dry basis (dscfm)
T_s	average sample gas temperature (°F)
17.64	conversion factor (°R/in. Hg)
460	°F to °R conversion constant

SAMPLE CALCULATIONS (CONTINUED)

13. VOC concentration (lb/scf)

$$E_{lb/scf} = \frac{(ppm)(MW)}{(385.3 \times 10^6)}$$

Where:

$E_{lb/scf}$	emission rate
C_{ppm}	measured concentration in the gas stream (ppm _v)
MW	molecular weight of NMP (99.13)
385.3	conversion factor

14. VOC emission (lb/hr)

$$E_{lb/hr} = (lb/scf)(60)(scfm)$$

Where:

$E_{lb/hr}$	emission rate
$E_{lb/scf}$	concentration
SCFM	flow rate
60 _{min/hr}	conversion factor

APPENDIX B
FIELD DATA SHEETS

FLOW / MOISTURE DATA SHEET

Location: GENERAL FLOW
 Unit: STEAM Outlet

Run: 1

Vent Testing

Method 1-4, 25A

Client: <u>General Iron</u>	Meter Lk Ck Pre: <u>004</u>	@ <u>23</u> "	
Plant: <u>CH/160 ZL</u>	Meter Lk Ck Post: <u>005</u>	@ <u>5</u> "	
Meter Operator: <u>Brian</u>	Pitot Lk Ck: <u>+0.00@ 71</u>	-0.00@ <u>6.6</u>	
Probe Operator: <u>bh</u>	Start Time (approx.): <u>0610 / 0835</u>		
Date: <u>5/25/18</u>	Stop Time (approx.): <u>0125</u>		
Meter Box No.: <u>70</u>	Static Press. (in. H ₂ O): <u>0.81</u>		
Y _d : <u>0.78</u>	Port Length (in.): <u>5.0</u>		
ΔH: <u>1.463</u>	First Point (all the way) (in.): <u>0.00</u>		

Pre Velocity Traverse				Moisture Train				Post Velocity Traverse			
Traverse Point	Pitot ΔP (in. H ₂ O)	Stack Temp, T _s (°F)	Mn/Pt. 5	Metered Vol. (ft ³)	Sample ΔH (in. H ₂ O)	Dry Gas Meter Tmo. (°F)	Exit Temp. (°F)	Pump Vac (in. H ₂ O)	Pitot ΔP (in. H ₂ O)	Stack Temp, T _s (°F)	Notes
1	2.1	112	5	375.45	1.5	71	70	55	3.6	1.9	116
2	2.2	112	10	397.61		77	70	56	3.6	1.7	117
3	2.3	112	15	399.46		74	71	55	3.0	1.7	117
4	2.2	113	20	403.48		84	75	52	3.0	1.8	116
5	2.2	113	25	407.29		96	77	54	3.0	1.7	116
6	2.4	114	30	411.19		94	77	51	3.0	1.7	116
7	2.5	115	35	415.13		94	80	62	3.0	1.7	116
8	2.4	116	40	419.06		94	81	62	3.0	1.9	117
1	2.3	104	45	412.04		94	82	63	3.0	2.0	116
2	2.3	107	50	416.94		94	83	63	3.0	1.5	116
3	2.4	108	55	421.01		94	83	63	3.0	1.7	116
4	2.5	108	60	424.92		94	84	64	3.0	1.6	117
5	2.4	109				94	84	64	3.0	1.7	117
6	2.4	110				94	84	64	3.0	1.6	118
7	2.4	106				94	84	64	3.0	1.9	118
8	2.2	102				94	84	64	3.0	2.0	118

Pre Velocity Traverse				Moisture Train				Post Velocity Traverse			
Traverse Point	Pitot ΔP (in. H ₂ O)	Stack Temp, T _s (°F)	Mn/Pt. 5	Metered Vol. (ft ³)	Sample ΔH (in. H ₂ O)	Dry Gas Meter Tmo. (°F)	Exit Temp. (°F)	Pump Vac (in. H ₂ O)	Pitot ΔP (in. H ₂ O)	Stack Temp, T _s (°F)	Notes
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7	2.5	115	35	415.13		94	80	62	3.0	1.7	116
8	2.4	116	40	419.06		94	81	62	3.0	1.9	117
1	2.3	104	45	412.04		94	82	63	3.0	2.0	116
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3	2.4	108	55	421.01		94	83	63	3.0	1.7	116
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5	2.4	109				94	84	64	3.0	1.7	117
6	2.4	110				94	84	64	3.0	1.6	118
7	2.4	106				94	84	64	3.0	1.9	118
8	2.2	102				94	84	64	3.0	2.0	118

Pre Velocity Traverse				Moisture Train				Post Velocity Traverse			
Traverse Point	Pitot ΔP (in. H ₂ O)	Stack Temp, T _s (°F)	Mn/Pt. 5	Metered Vol. (ft ³)	Sample ΔH (in. H ₂ O)	Dry Gas Meter Tmo. (°F)	Exit Temp. (°F)	Pump Vac (in. H ₂ O)	Pitot ΔP (in. H ₂ O)	Stack Temp, T _s (°F)	Notes
1	2.1	112	5	375.45	1.5	71	70	55	3.6	1.9	116
2	2.2	112	10	397.61		77	70	56	3.6	1.7	117
3	2.3	112	15	399.46		74	71	55	3.0	1.7	117
4	2.2	113	20	403.48		84	75	52	3.0	1.8	116
5	2.2	113	25	407.29		96	77	54	3.0	1.7	116
6	2.4	114	30	411.19		94	77	51	3.0	1.7	116
7	2.5	115	35	415.13		94	80	62	3.0	1.7	116
8	2.4	116	40	419.06		94	81	62	3.0	1.9	117
1	2.3	104	45	412.04		94	82	63	3.0	2.0	116
2	2.3	107	50	416.94		94	83	63	3.0	1.5	116
3	2.4	108	55	421.01		94	83	63	3.0	1.7	116
4	2.5	108	60	424.92		94	84	64	3.0	1.6	117
5	2.4	109				94	84	64	3.0	1.7	117
6	2.4	110				94	84	64	3.0	1.6	118
7	2.4	106				94	84	64	3.0	1.9	118
8	2.2	102				94	84	64	3.0	2.0	118

Avg.	1.6222	110.94	84.80	1.3380	117.19

G10000222

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1.4301

1141.07

FLOW / MOISTURE DATA SHEET

Location: General Iron
 Unit: Shredder
Inlet
Outlet

Run: 2 Job Testing Method 1-4, 25A

Client: <u>General Iron</u>	Meter Lk Ck Pre: <u>.901</u> @ <u>14</u> "
Plant: <u>Chicago</u> <u>TL</u>	Meter Lk Ck Post: <u>.901</u> @ <u>6</u> "
Meter Operator: <u>LW</u> <u>BS</u>	Pilot Lk Ck: <u>+00</u> @ <u>711-00@66"</u>
Probe Operator: <u>LW</u>	Start Time (approx.): <u>9:44</u>
Date: <u>5/25/14</u>	Stop Time (approx.): <u>10:54</u>
Meter Box No.: <u>70</u>	Static Press. (in. H ₂ O): <u>-0.41</u>
Y _c : <u>0.974</u>	Port Length (in.): <u>5 in</u>
ΔH: <u>1.463</u>	First Point (all the way): (in) (out)
	Duct Dimensions (in.): <u>60</u>

Pre Velocity Traverse				Moisture Train				Post Velocity Traverse				
Traverse Point	Pilot ΔP	Stack Temp, T _s	Stack Temp, T _m	Metered Vol., Min./Ptc.	Metered Vol., (ft ³)	Sample ΔH (in. H ₂ O)	Dry Gas Meter Tmo (°F)	Exit Temp. (°F)	Pump Vac (in. H ₂ O)	Plttrt ΔP (in. H ₂ O)	Stack Temp, T _s (°F)	Notes
1	1.9	114	105	5	439.23	1.5	85	83	50	2.6	113	
2	1.7	117	108	10	442.90		103	96	51	2.0	117	
3	1.7	117	103	15	446.67		103	96	51	2.0	119	
4	1.6	114	104	20	451.74		104	97	52	2.0	120	
5	1.7	116	106	25	455.86		103	99	53	2.0	120	
6	1.7	116	104	30	460.81		104	99	54	2.0	120	
7	1.9	117	105	35	464.17		103	99	56	2.0	120	
8	2.0	116	106	40	469.33		103	90	57	2.0	120	
1	1.5	118	105	45	472.56		103	91	58	2.0	111	
2	1.7	118	105	50	476.66		104	91	58	2.0	112	
3	1.6	118	105	55	480.49		104	92	60	2.0	118	
4	1.7	116	106	60	484.95		100	41	60	2.0	119	
5	1.4	118									1.6	119
6	1.9	118									1.5	118
7	2.0	118									1.9	120
8	2.1	118									1.7	108
Avg.	1.3380	117.15									1.5535	116.44

1,414,58 116.82

Stack Test Group, Inc.

FLOW / MOISTURE DATA SHEET

Location: General Iron
Unit: Sheroders Outlet
Inlet

Run: 3

YOM Testing

Method 1-4, 25A

Avg.	1.5636	111.44		99.68		13500	12173
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1. 4/558

119.10

Stack Test Group, Inc.

G|0000224

APPENDIX C
FIELD PARAMETER SHEET

STACK TEST GROUP, INC.
Air Quality Services

Exhaust VOC Sampling Train Calculations

Client: General Iron
 Project No: 18-3042
 Date: 05/25/18
 Source: Shredder Exhaust

Test No:	T1	T2	T3	Avg.
Start Time:	08:35 AM	09:49 AM	11:05 AM	
Finish Time:	09:35 AM	10:48 AM	12:26 PM	
Pitot Cal. Factor:	0.84	0.84	0.84	
Meter Calibration Factor:	0.978	0.978	0.978	
Stack Length, inches:	0	0	0	
Stack Width, inches:	0	0	0	
Stack Diameter, inches:	50	50	50	
Barometric Pressure, inches Hg:	29.33	29.33	29.33	
Static Pressure in Stack, Inches H2O:	-0.81	-0.81	-0.81	
Duration of Sample, minutes:	60	60	60	
Meter Start Volume:	387.65	435.08	485.89	
Meter Final Volume:	434.92	484.98	536.22	
Average Meter Pressure, Inches H2O:	1.50	1.50	1.50	1.5000
Average Meter Temperature, degrees F:	84.5	95.04	99.58	93.0
Average Sqrt. Velocity Pressure:	1.4301	1.4458	1.4553	1.4437
Stack Gas Temperature, degrees F:	114.1	116.8	119.1	116.7
% Carbon Dioxide:	0.2	0.2	0.1	0.2
% Oxygen:	20.5	20.5	20.7	20.6
% Carbon Monoxide:	0.0	0.0	0.0	0.0
Liquid Volume Collected, milliliters:	40	38	39	39.0

Sample Train Calculations

Meter Volume, Actual:	47.270	49.900	50.330	49.167
Meter Volume, STP:	44.093	45.665	45.680	45.146
Volume of Water Vapor Condensed:	1.883	1.789	1.836	1.836
Total Gas Sampled:	45.976	47.454	47.516	46.982
% Moisture:	4.10	3.77	3.86	3.91
Area of Stack, Square Feet:	13.64	13.64	13.64	13.64
% Excess Air at Test Location:	4710.5	4710.5	9913.8	6444.9
Molecular Weight dry, lb/lb-Mole:	28.85	28.85	28.84	28.85
Molecular Weight wet, lb/lb-Mole:	28.41	28.44	28.42	28.42
Absolute Stack Gas Pressure, in Hg:	29.27	29.27	29.27	29.27

Velocity and Flow Calculations

Average Stack Gas Velocity FPS:	85.33	86.43	87.20	86.32
Stack Gas Flow Rate, ACFM:	69,834	70,734	71,364	70,644
Stack Gas Flow Rate, SCFM:	62,834	63,341	63,654	63,276
Stack Gas Flow Rate, DSCF/HR:	3,615,492	3,657,182	3,671,800	3,648,158
Stack Gas Flow Rate, DSCFM:	60,258	60,953	61,197	60,803

VOC Calculations (Uncorrected):

PPMv as Propane:	281.0	169.9	270.3	240.4
LBS/DSCF:	3.21E-05	1.94E-05	3.09E-05	2.75E-05
LBS/HR:	120.98	73.74	117.89	104.20

VOC Calculations (Corrected):

PPM Chloromethane:	0.02	0.02	0.02	0.02
PPM Chloromethane RF Adjusted:	0.01	0.01	0.01	0.01
PPM Freon 22:	8.34	2.83	0.00	3.72
PPM Freon 22 RF Adjusted:	3.98	1.35	0.00	1.78
PPM Freon 12:	0.88	0.41	0.89	0.73
PPM Freon 12 RF Adjusted:	1.03	0.48	1.05	0.85
PPM Freon 152A:	0.00	3.84	1.56	1.80
PPM Freon 152A RF Adjusted:	0.00	4.42	1.79	2.07
PPM Freon 134A:	0.02	0.02	0.02	0.02
PPM Freon 134A RF Adjusted:	0.02	0.02	0.02	0.02
PPM Octamethylcyclotetrasiloxane:	2.14	0.00	0.00	0.71
PPM Octamethylcyclotetrasiloxane RF Adjusted:	2.46	0.00	0.00	0.82
PPM Acetone:	2.71	14.73	29.91	15.8
PPM Acetone RF Adjusted:	1.95	10.61	21.54	11.4
PPM Methylene Chloride:	0.22	0.18	0.18	0.2
PPM Methylene Chloride RF Adjusted:	0.24	0.20	0.20	0.2
PPM Tetrachloroethylene:	0.03	0.03	0.04	0.0
PPM Tetrachloroethylene RF Adjusted:	0.04	0.04	0.05	0.0
PPM Freon 11**:	2.000	10.21	5.98	6.1
PPM Tetrachloroethylene RF Adjusted**:	0.95	4.87	2.85	2.9
PPM Methane (as Propane):	1.10	1.03	1.13	1.09
PPM Ethane (as Propane):	0.42	0.30	0.30	0.34
PPMv as Propane (Corrected):	268.8	146.6	241.4	218.9
LBS/DSCF (Corrected):	3.07E-05	1.67E-05	2.76E-05	2.50E-05
LBS/HR (Corrected):	115.72	63.61	105.27	94.87

* See Appendix G for response factor determinations for each compound.

** Freon 11 is an ESTIMATED response factor. The laboratory was not able to obtain a Freon 11 sample in order to develop a response factor by the issuance deadline of this report.

APPENDIX D
CALIBRATIONS

General Iron
18-3042
Chicago, Illinois
EPA Method 25A
Shredder Exhaust
Exhaust Stack (1,000 Range)

Analyte	VOC	Wet	
	Value	Response	Calibration Error
Initial Calibration	1145.0		
***Span			
High	916.0	927.0	1.20%
Mid	506.3	527.0	4.09%
Low	305.0	316.0	3.61%
Zero	0.0	1.0	0.09%

*Pre Upscale and Corrected Run Average cells must be adjusted if a high or low calibration gas is used for post calibration upscale checks.

***All Drift and Bias calculations for VOC are based off of the most lenient Span value possible (High Cal gas is 80% of Span). May not agree with report values if a more restrictive span is identified.

Type	Run Average	Pre Zero	Post Zero	*Pre Upscale	Post Upscale	Zero System Bias	Upscale System Bias	Zero Drift	Upscale Drift
Initial System Bias Check									
Run 1	281.0	1.0	10.0	527.0	522.0			0.79%	0.44%
Run 2	169.9	10.0	10.0	522.0	534.0			0.00%	1.05%
Run 3	270.3	10.0	11.0	534.0	529.0			0.09%	0.44%

General Iron
18-3042
Chicago, Illinois
EPA Method 25A
Shredder Exhaust
Exhaust Stack (10,000 range)

Analyte	VOC	Wet		
Initial Calibration	Value	Response	Calibration Error	
***Span	10621.3			
High	8497.0	8421.0	0.89%	
Mid	4988.0	4861.0	2.55%	
Low	2976.0	2955.0	0.71%	
Zero	0.0	1.0	0.01%	

*Pre Upscale and Corrected Run Average cells must be adjusted if a high or low calibration gas is used for post calibration upscale checks.

***All Drift and Bias calculations for VOC are based off of the most lenient Span value possible (High Cal gas is 80% of Span). May not agree with report values if a more restrictive span is identified.

Type	Run Average	Pre Zero	Post Zero	*Pre Upscale	Post Upscale	Zero System Bias	Upscale System Bias	Zero Drift	Upscale Drift
Initial System Bias Check									
Run 1	281.0	1.0	10.0	4861.0	4900.0			0.08%	0.37%
Run 2	169.9	10.0	10.0	4861.0	4900.0			0.00%	0.37%
Run 3	270.3	10.0	11.0	4861.0	4900.0			0.01%	0.37%

General Iron 18-3042
 Chicago, Illinois
 5/25/2018
 Shredder Exhaust

Analyte	Oxygen			Dry
Initial Calibration	Value	Response		Calibration Error
High	23.20	23.20		0.00%
Mid	11.91	12.00		0.39%
Low (Zero)	0.00	0.00		0.00%

*Corrected Run Average and Upscale System Bias cell formulas must be adjusted if the high calibration gas is used for post calibration upscale checks.

Type	Run Average	Pre Zero	Post Zero	Pre Upscale	Post Upscale	*Corrected Run Average	Zero System Bias	*Upscale System Bias	Zero Drift	Upscale Drift
Initial System Bias Check				0.0		12.0		0.00%	0.00%	
Run 1	20.7	0.0	0.0	12.0	12.0	20.5	0.00%	0.00%	0.00%	0.00%
Run 2	20.7	0.0	0.0	12.0	12.0	20.5	0.00%	0.00%	0.00%	0.00%
Run 3	20.7	0.0	0.1	12.0	11.9	20.7	0.43%	0.43%	0.43%	0.43%

Analyte	Carbon Dioxide			Dry
Initial Calibration	Value	Response		Calibration Error
High	24.01	24.00		0.04%
Mid	12.15	12.00		0.62%
Low (Zero)	0.00	0.10		0.42%

*Corrected Run Average and Upscale System Bias cell formulas must be adjusted if the high calibration gas is used for post calibration upscale checks.

Type	Run Average	Pre Zero	Post Zero	Pre Upscale	Post Upscale	*Corrected Run Average	Zero System Bias	*Upscale System Bias	Zero Drift	Upscale Drift
Initial System Bias Check				0.0		12.0		0.42%	0.00%	
Run 1	0.2	0.0	0.0	12.0	12.0	0.2	0.42%	0.00%	0.00%	0.00%
Run 2	0.2	0.0	0.1	12.0	12.0	0.2	0.00%	0.00%	0.42%	0.00%
Run 3	0.2	0.1	0.1	12.0	11.8	0.1	0.00%	0.83%	0.00%	0.83%

APEX INSTRUMENTS
EPA Method 5
522 Series Meter Box Calibrator
Pre-Test Orifice Method
English Meter Box Units. English

File Name: S:\Calibrations\MeterCalls\|Meter Cal Spread Sheet.xls]27 100203
Revised: 7/21/95 Version: 2.2

Date: 11/9/17 Barometric Pressure: 29.65 (in. Hg)
Theoretical Critical Vacuum: 13.99 (in. Hg)

IMPORTANT For valid test results, the Actual Vacuum should be 1 to 2 in. Hg greater than the Theoretical Critical Vacuum shown above.
IMPORTANT The Critical Orifice Coefficient, K', must be entered in English units. (ft)³(deg R)·0.5/(in.(Hg))^{1/2}(min)).

DRY GAS METER READINGS

dH (in H2O)	Time (min)	Volume Initial (cu ft)	Volume Final (cu ft)	Initial Temps.			Final Temps.			Orifice K' Orifice Serial# Coefficient			Actual - Ambient Temperature -		
				Total (cu ft)	Inlet (deg F)	Outlet (deg F)	Inlet (deg F)	Outlet (deg F)	(in Hg)	Initial (deg F)	Final (deg F)	Average (deg F)			
0.51	13.00	837.620	843.720	6.100	65.0	65.0	67.0	64.0	23.0	68.0	68.0	68.0			
0.93	10.00	843.940	850.140	6.200	68.0	68.0	71.0	66.0	CJ.48	0.350	22.0	68.0			
1.60	11.00	850.300	859.060	8.760	71.0	65.0	77.0	68.0	CJ.55	0.461	20.0	68.0			
3.00	19.00	859.250	880.000	20.750	76.0	67.0	91.0	73.0	CJ.63	0.598	17.5	68.0			
4.50	6.00	888.310	880.200	8.110	86.0	73.0	97.0	75.0	CJ.73	0.321	15.0	68.0			
									CJ.81	1.072					

RESULTS

-CRITICAL OFFICE READINGS-

Final Temps. (deg F)	Inlet (deg F)	Outlet (deg F)	Orifice K' Orifice Serial# (number)	Coefficient (see above) C.J48	Actual - Ambient Temperature -		
					Vacuum (in Hg)	Initial (deg F)	Average (deg F)
67.0	64.0	64.0	C.J48	0.350	23.0	68.0	68.0
71.0	66.0	66.0	C.J55	0.461	22.0	68.0	68.0
77.0	68.0	68.0	C.J63	0.598	20.0	68.0	68.0
91.0	73.0	73.0	C.J73	0.821	17.5	68.0	68.0
97.0	75.0	75.0	C.J81	1.012	15.0	68.0	68.0

ORIFICE

CALIBRATION FACTOR dh@	Variation		
	Value (in H ₂ O)	Value (mm H ₂ O)	Variation (in H ₂ O)
1.400	35.56	-0.06	
1.477	37.51	0.01	
1.500	38.10	0.03	
1.486	37.74	0.02	
1.454	36.93	-0.00	

37.17 <---- Average dH@

Note: For Calibration Factor Y, the ratio of the reading of the calibration meter to the dry gas meter, acceptable tolerance of individual values from the average is +0.02.

For Orifice Calibration Factor dH@, the orifice differential pressure in inches of H₂O that equates to 0.75 cfm of air at 68°F and 29.92 inches of Hg, acceptable tolerance of individual values from the average is +0.2.

SIGNED: John Doe

Date: _____

**Pitot Tube
Calibration Sheet**

Client General Iron
Plant Chicago, IL
Pitot ID P-7A-S-Type

External Tubing Diameter	0.375	inches
Base To Opening Plane Distance(P_a)	0.521	inches
Base To Opening Plane Distance(P_b)	0.523	inches
Pitot Coefficient	0.84	

	Measured	Allowable
P_a/D_t	1.389	1.05-1.50
P_b/D_t	1.395	1.05-1.50
Angle α°	0.0	10.0
Angle α°	0.0	10.0
Angle β°	0.0	5.0
Angle β°	0.0	5.0
z (inches)	0	0.125 in.
w(inches)	0.000	0.031 in.

Signature R. Schueller

Date 1/5/2018

Pyrometer Calibration Sheet

STG Project No. 18-3042

Client: General Iron

Chicago, IL

Date: 5/25/2018

Date Calibrated: 1/5/2018

Temperature Scale Used: °F

Probe No. STG-7A

Reference Used: Mercury Thermometer

Calibration Reference Settings °F	Pyrometer Reading °F
29	30
76	76
212	213

Calibrated by: R. Schueller

APPENDIX E
VOC DATALOGGER RECORDINGS

General Iron 18-3042
 Chicago, Illinois
 Shredder Exhaust
 Method 26A
 Run 1

Date	Time	O ₂ %	CO ₂ %	VOC PPM _{vw}
2018/05/25	8:35:00 AM	20.7	0.2	322
2018/05/25	8:36:00 AM	20.7	0.2	309
2018/05/25	8:37:00 AM	20.7	0.2	295
2018/05/25	8:38:00 AM	20.8	0.2	234
2018/05/25	8:39:00 AM	20.7	0.2	202
2018/05/25	8:40:00 AM	20.7	0.2	204
2018/05/25	8:41:00 AM	20.7	0.2	441
2018/05/25	8:42:00 AM	20.7	0.2	157
2018/05/25	8:43:00 AM	20.7	0.2	95
2018/05/25	8:44:00 AM	20.7	0.2	297
2018/05/25	8:45:00 AM	20.7	0.2	387
2018/05/25	8:46:00 AM	20.7	0.2	414
2018/05/25	8:47:00 AM	20.8	0.2	264
2018/05/25	8:48:00 AM	20.7	0.2	564
2018/05/25	8:49:00 AM	20.7	0.2	177
2018/05/25	8:50:00 AM	20.7	0.2	788
2018/05/25	8:51:00 AM	20.7	0.2	252
2018/05/25	8:52:00 AM	20.7	0.2	577
2018/05/25	8:53:00 AM	20.7	0.2	225
2018/05/25	8:54:00 AM	20.7	0.2	427
2018/05/25	8:55:00 AM	20.7	0.2	430
2018/05/25	8:56:00 AM	20.8	0.2	176
2018/05/25	8:57:00 AM	20.7	0.2	124
2018/05/25	8:58:00 AM	20.7	0.2	408
2018/05/25	8:59:00 AM	20.8	0.2	197
2018/05/25	9:00:00 AM	20.8	0.2	172
2018/05/25	9:01:00 AM	20.7	0.2	193
2018/05/25	9:02:00 AM	20.7	0.2	218
2018/05/25	9:03:00 AM	20.7	0.2	160
2018/05/25	9:04:00 AM	20.7	0.2	459
2018/05/25	9:05:00 AM	20.7	0.2	1062
2018/05/25	9:06:00 AM	20.7	0.2	355
2018/05/25	9:07:00 AM	20.7	0.2	211
2018/05/25	9:08:00 AM	20.7	0.2	772
2018/05/25	9:09:00 AM	20.7	0.2	181
2018/05/25	9:10:00 AM	20.8	0.2	42
2018/05/25	9:11:00 AM	20.7	0.2	449
2018/05/25	9:12:00 AM	20.7	0.2	296
2018/05/25	9:13:00 AM	20.7	0.2	213
2018/05/25	9:14:00 AM	20.7	0.2	174
2018/05/25	9:15:00 AM	20.7	0.2	104
2018/05/25	9:16:00 AM	20.7	0.2	321
2018/05/25	9:17:00 AM	20.7	0.2	163
2018/05/25	9:18:00 AM	20.7	0.2	242
2018/05/25	9:19:00 AM	20.7	0.2	357
2018/05/25	9:20:00 AM	20.7	0.2	52
2018/05/25	9:21:00 AM	20.7	0.2	100
2018/05/25	9:22:00 AM	20.7	0.2	214
2018/05/25	9:23:00 AM	20.8	0.2	183
2018/05/25	9:24:00 AM	20.7	0.2	288
2018/05/25	9:25:00 AM	20.7	0.2	212
2018/05/25	9:26:00 AM	20.7	0.2	111
2018/05/25	9:27:00 AM	20.7	0.2	194
2018/05/25	9:28:00 AM	20.7	0.2	292
2018/05/25	9:29:00 AM	20.7	0.2	184
2018/05/25	9:30:00 AM	20.7	0.2	190
2018/05/25	9:31:00 AM	20.7	0.2	177
2018/05/25	9:32:00 AM	20.7	0.2	255
2018/05/25	9:33:00 AM	20.7	0.2	209
2018/05/25	9:34:00 AM	20.7	0.2	87
	Avg.	20.7	0.2	281.0

General Iron 18-3042
 Chicago, Illinois
 Shredder Exhaust
 Method 25A
 Run 2

Date	Time	O ₂ %	CO ₂ %	VOC PPM _{v/w}
2018/05/25	9:49:00 AM	20.7	0.2	11
2018/05/25	9:50:00 AM	20.7	0.2	29
2018/05/25	9:51:00 AM	20.7	0.2	59
2018/05/25	9:52:00 AM	20.7	0.2	104
2018/05/25	9:53:00 AM	20.7	0.2	43
2018/05/25	9:54:00 AM	20.7	0.2	204
2018/05/25	9:55:00 AM	20.7	0.2	92
2018/05/25	9:56:00 AM	20.7	0.2	113
2018/05/25	9:57:00 AM	20.7	0.2	103
2018/05/25	9:58:00 AM	20.7	0.2	43
2018/05/25	9:59:00 AM	20.8	0.2	55
2018/05/25	10:00:00 AM	20.7	0.2	441
2018/05/25	10:01:00 AM	20.8	0.2	183
2018/05/25	10:02:00 AM	20.7	0.2	214
2018/05/25	10:03:00 AM	20.7	0.2	244
2018/05/25	10:04:00 AM	20.7	0.2	150
2018/05/25	10:05:00 AM	20.7	0.2	37
2018/05/25	10:06:00 AM	20.7	0.2	110
2018/05/25	10:07:00 AM	20.7	0.2	152
2018/05/25	10:08:00 AM	20.7	0.2	455
2018/05/25	10:09:00 AM	20.7	0.2	150
2018/05/25	10:10:00 AM	20.7	0.2	97
2018/05/25	10:11:00 AM	20.8	0.2	106
2018/05/25	10:12:00 AM	20.7	0.2	133
2018/05/25	10:13:00 AM	20.7	0.2	291
2018/05/25	10:14:00 AM	20.7	0.2	171
2018/05/25	10:15:00 AM	20.7	0.2	145
2018/05/25	10:16:00 AM	20.7	0.2	199
2018/05/25	10:17:00 AM	20.7	0.2	100
2018/05/25	10:18:00 AM	20.7	0.2	283
2018/05/25	10:19:00 AM	20.7	0.2	162
2018/05/25	10:20:00 AM	20.7	0.2	175
2018/05/25	10:21:00 AM	20.7	0.2	236
2018/05/25	10:22:00 AM	20.7	0.2	174
2018/05/25	10:23:00 AM	20.7	0.2	192
2018/05/25	10:24:00 AM	20.7	0.2	139
2018/05/25	10:25:00 AM	20.7	0.2	414
2018/05/25	10:26:00 AM	20.7	0.2	96
2018/05/25	10:27:00 AM	20.7	0.2	201
2018/05/25	10:28:00 AM	20.7	0.2	164
2018/05/25	10:29:00 AM	20.7	0.2	107
2018/05/25	10:30:00 AM	20.7	0.2	225
2018/05/25	10:31:00 AM	20.7	0.2	171
2018/05/25	10:32:00 AM	20.7	0.2	264
2018/05/25	10:33:00 AM	20.7	0.2	401
2018/05/25	10:34:00 AM	20.7	0.2	181
2018/05/25	10:35:00 AM	20.7	0.2	203
2018/05/25	10:36:00 AM	20.7	0.2	127
2018/05/25	10:37:00 AM	20.7	0.2	106
2018/05/25	10:38:00 AM	20.7	0.2	293
2018/05/25	10:39:00 AM	20.7	0.2	166
2018/05/25	10:40:00 AM	20.7	0.2	489
2018/05/25	10:41:00 AM	20.7	0.2	317
2018/05/25	10:42:00 AM	20.7	0.2	61
2018/05/25	10:43:00 AM	20.7	0.2	98
2018/05/25	10:44:00 AM	20.7	0.2	109
2018/05/25	10:45:00 AM	20.7	0.2	92
2018/05/25	10:46:00 AM	20.7	0.2	66
2018/05/25	10:47:00 AM	20.7	0.2	145
2018/05/25	10:48:00 AM	20.7	0.2	102
Avg.		20.7	0.2	169.9

General Iron 18-3042
 Chicago, Illinois
 Shredder Exhaust
 Method 25A
 Run 3

Date	Time	O ₂ %	CO ₂ %	VOC PPMvv
2018/05/25	11:05:00 AM	20.7	0.2	11
2018/05/25	11:06:00 AM	20.7	0.2	20
2018/05/25	11:07:00 AM	20.7	0.2	76
2018/05/25	11:08:00 AM	20.7	0.2	1934
2018/05/25	11:09:00 AM	20.7	0.2	404
2018/05/25	11:10:00 AM	20.7	0.2	92
2018/05/25	11:11:00 AM	20.7	0.2	80
2018/05/25	11:12:00 AM	20.7	0.2	96
2018/05/25	11:13:00 AM	20.7	0.2	117
2018/05/25	11:14:00 AM	20.7	0.2	101
2018/05/25	11:15:00 AM	20.7	0.2	156
2018/05/25	11:16:00 AM	20.7	0.2	102
2018/05/25	11:17:00 AM	20.7	0.2	125
2018/05/25	11:18:00 AM	20.7	0.2	62
2018/05/25	11:19:00 AM	20.7	0.2	41
2018/05/25	11:20:00 AM	20.7	0.2	29
2018/05/25	11:21:00 AM	20.7	0.2	23
2018/05/25	11:22:00 AM	20.7	0.2	20
2018/05/25	11:23:00 AM	20.8	0.2	18
2018/05/25	11:24:00 AM	20.7	0.2	17
2018/05/25	11:25:00 AM	20.7	0.2	15
2018/05/25	11:26:00 AM	20.7	0.2	15
2018/05/25	11:27:00 AM	20.7	0.2	17
2018/05/25	11:28:00 AM	20.7	0.2	13
2018/05/25	11:29:00 AM	20.7	0.2	13
2018/05/25	11:30:00 AM	20.7	0.2	21
2018/05/25	11:31:00 AM	20.7	0.2	26
2018/05/25	11:32:00 AM	20.7	0.2	210
2018/05/25	11:33:00 AM	20.7	0.2	112
2018/05/25	11:34:00 AM	20.7	0.2	103
2018/05/25	11:35:00 AM	20.7	0.2	33
2018/05/25	11:36:00 AM	20.7	0.2	20
2018/05/25	11:37:00 AM	20.7	0.2	17
2018/05/25	11:38:00 AM	20.7	0.2	14
2018/05/25	11:39:00 AM	20.7	0.2	12
2018/05/25	11:40:00 AM	20.7	0.2	11
2018/05/25	11:41:00 AM	20.7	0.2	11
2018/05/25	11:42:00 AM	20.7	0.2	11
2018/05/25	11:43:00 AM	20.7	0.2	10
2018/05/25	11:44:00 AM	20.7	0.2	12
2018/05/25	11:45:00 AM	20.7	0.2	39
2018/05/25	11:46:00 AM	20.7	0.2	136
2018/05/25	11:47:00 AM	20.7	0.2	2752
2018/05/25	11:48:00 AM	20.7	0.2	525
2018/05/25	11:49:00 AM	20.7	0.2	234
2018/05/25	11:50:00 AM	20.7	0.2	233
2018/05/25	11:51:00 AM	20.7	0.2	181
2018/05/25	11:52:00 AM	20.7	0.2	224
2018/05/25	11:53:00 AM	20.7	0.2	108
2018/05/25	11:54:00 AM	20.7	0.2	118
2018/05/25	11:55:00 AM	20.7	0.2	400
2018/05/25	11:56:00 AM	20.7	0.2	343
2018/05/25	11:57:00 AM	20.7	0.2	90
2018/05/25	11:58:00 AM	20.7	0.2	216
2018/05/25	11:59:00 AM	20.7	0.2	158
2018/05/25	12:00:00 PM	20.7	0.2	143
2018/05/25	12:01:00 PM	20.7	0.2	171
2018/05/25	12:02:00 PM	20.7	0.2	254
2018/05/25	12:03:00 PM	20.7	0.2	277
2018/05/25	12:04:00 PM	20.7	0.2	698
2018/05/25	12:05:00 PM	20.7	0.2	375
2018/05/25	12:06:00 PM	20.7	0.2	224
2018/05/25	12:07:00 PM	20.7	0.2	142
2018/05/25	12:08:00 PM	20.7	0.2	281
2018/05/25	12:09:00 PM	20.7	0.2	241
2018/05/25	12:10:00 PM	20.7	0.2	149
2018/05/25	12:11:00 PM	20.7	0.2	228
2018/05/25	12:12:00 PM	20.7	0.2	323
2018/05/25	12:13:00 PM	20.7	0.2	647
2018/05/25	12:14:00 PM	20.7	0.2	223
2018/05/25	12:15:00 PM	20.7	0.2	86
2018/05/25	12:16:00 PM	20.7	0.2	199
2018/05/25	12:17:00 PM	20.7	0.2	156
2018/05/25	12:18:00 PM	20.7	0.2	206
2018/05/25	12:19:00 PM	20.7	0.2	157
2018/05/25	12:20:00 PM	20.7	0.2	274
2018/05/25	12:21:00 PM	20.7	0.2	300
2018/05/25	12:22:00 PM	20.7	0.2	514
2018/05/25	12:23:00 PM	20.7	0.2	338
2018/05/25	12:24:00 PM	20.7	0.2	121
2018/05/25	12:25:00 PM	20.7	0.2	77
	Avg.	20.7	0.2	270.3

*Shredder was down during this period. These numbers are not included in the average.

APPENDIX F
CALIBRATION GAS CERTIFICATION SHEETS

CERTIFICATE OF ANALYSIS

Grade of Product: EPA Protocol

Part Number: E03NI76E15A0295
Cylinder Number: SG9133821BAL
Laboratory: ASG - Chicago - IL
PGVP Number: B12016
Gas Code: CO2,O2,BALN

Reference Number: 54-124572685-1
Cylinder Volume: 152.5 CF
Cylinder Pressure: 2015 PSIG
Valve Outlet: 590
Certification Date: Aug 22, 2016

Expiration Date: Aug 22, 2024

Airgas Specialty Gases

Airgas USA, LLC

12722 South Wentworth Ave.
Chicago, IL 60628
773-785-3000 Fax: 773-785-1928
Airgas.com

Certification performed in accordance with "EPA Traceability Protocol for Assay and Certification of Gaseous Calibration Standards (May 2012)" document EPA 600/R-12/531, using the assay procedures listed. Analytical Methodology does not require correction for analytical interference. This cylinder has a total analytical uncertainty as stated below with a confidence level of 95%. There are no significant impurities which affect the use of this calibration mixture. All concentrations are on a volume/volume basis unless otherwise noted.

Do Not Use This Cylinder below 100 psig, i.e. 0.7 megapascals.

ANALYTICAL RESULTS					
Component	Requested Concentration	Actual Concentration	Protocol Method	Total Relative Uncertainty	Assay Dates
CARBON DIOXIDE	12.00 %	12.15 %	G1	+/- 1.0% NIST Traceable	08/22/2016
OXYGEN	12.00 %	11.91 %	G1	+/- 1.0% NIST Traceable	08/22/2016
NITROGEN	Balance				

CALIBRATION STANDARDS					
Type	Lot ID	Cylinder No	Concentration	Uncertainty	Expiration Date
NTRM	13060817	CC416652	24.04 % CARBON DIOXIDE/NITROGEN	+/- 0.6%	May 16, 2019
NTRM	12062016	CC367570	22.88 % OXYGEN/NITROGEN	+/- 0.2%	Apr 24, 2018

ANALYTICAL EQUIPMENT					
Instrument/Make/Model	Analytical Principle	Last Multipoint Calibration			
CO2-1 HORIBA VIA-510 V1E3H7P5	NDIR	Aug 13, 2016			
O2-1 HORIBA MPA-510 3VUYL9NR	Paramagnetic	Aug 22, 2016			

Triad Data Available Upon Request



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G10000240



an Air Liquide company

CERTIFICATE OF ANALYSIS

Grade of Product: EPA Protocol

Part Number: E03NI52E15A38Q7
 Cylinder Number: CC183526
 Laboratory: ASG - Chicago - IL
 PGVP Number: B12016
 Gas Code: CO2,O2,BALN

Reference Number: 54-124572686-1
 Cylinder Volume: 163.9 CF
 Cylinder Pressure: 2015 PSIG
 Valve Outlet: 296
 Certification Date: Aug 26, 2016

Airgas Specialty Gases

Airgas USA, LLC

12722 South Wentworth Ave.
 Chicago, IL 60628
 773-785-3000 Fax: 773-785-1928
Airgas.com

Expiration Date: Aug 26, 2024

Certification performed in accordance with "EPA Traceability Protocol for Assay and Certification of Gaseous Calibration Standards (May 2012)" document EPA 600/R-12/531, using the assay procedures listed. Analytical Methodology does not require correction for analytical interference. This cylinder has a total analytical uncertainty as stated below with a confidence level of 95%. There are no significant impurities which affect the use of this calibration mixture. All concentrations are on a volume/volume basis unless otherwise noted.

Do Not Use This Cylinder below 100 psig, i.e. 0.7 megapascals.

ANALYTICAL RESULTS					
Component	Requested Concentration	Actual Concentration	Protocol Method	Total Relative Uncertainty	Assay Dates
CARBON DIOXIDE	24.00 %	24.01 %	G1	+/- 1.0% NIST Traceable	08/26/2016
OXYGEN	24.00 %	23.18 %	G2	+/- 1.1% NIST Traceable	08/26/2016
NITROGEN	Balance				

CALIBRATION STANDARDS					
Type	Lot ID	Cylinder No	Concentration	Uncertainty	Expiration Date
NTRM	13060817	CC416652	24.04 % CARBON DIOXIDE/NITROGEN	+/- 0.6%	May 16, 2019
NTRM	06120112	CC195607	9.898 % OXYGEN/NITROGEN	+/- 0.7%	Jun 26, 2018

ANALYTICAL EQUIPMENT		
Instrument/Make/Model	Analytical Principle	Last Multipoint Calibration
CO2-1 HORIBA VIA-510 V1E3H7P5	NDIR	Aug 13, 2016
O2-1 HORIBA MPA-510 3VUYL9NR	Paramagnetic	Aug 22, 2016

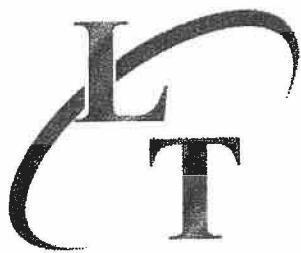
Triad Data Available Upon Request



Approved for Release

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G10000241



LIQUID TECHNOLOGY CORPORATION
"INDUSTRY LEADER IN SPECIALTY GASES"

Certificate of Analysis
- EPA PROTOCOL GAS -

Customer Stack Test Group (Ottawa, IL)
Date April 30, 2014
Delivery Receipt DR-51311
Gas Standard 900 ppm Propane/Nitrogen - EPA PROTOCOL
Final Analysis Date April 28, 2014
Expiration Date April 28, 2022

Component Propane
Balance Gas Air

Analytical Data:
EPA Protocol, Section No. 2.2, Procedure G-1

DO NOT USE BELOW 100 psig

Reported Concentrations
Propane: 916 ppm +/- 3.0 ppm
Nitrogen: Balance

Reference Standards:

SRM/GMIS:	GMIS	GMIS
Cylinder Number:	CC-125618	CC-165614
Concentration:	497.23 ppm Propane/Nitrogen	1011.92 ppm Propane/Nitrogen
Expiration Date:	04/09/20	04/09/20

Certification Instrumentation

Component:	Propane
Make/Model:	Agilent 7890A
Serial Number:	CN10736166
Principal of Measurement:	GC-FID
Last Calibration:	April 09, 2014

Cylinder Data

Cylinder Serial Number:	CC-185323	Cylinder Outlet:	CGA 350
Cylinder Volume:	140 Cubic Feet	Cylinder Pressure:	2000 psig, 70°F

Analytical Uncertainty and NIST Traceability are in compliance with EPA-600/R-12/531.

Certified by:

Cole Dylewski

PGVP Vendor ID: E12014

CERTIFICATE OF ANALYSIS

Grade of Product: EPA Protocol

Part Number: E02NI99E15A0932 Reference Number: 54-124545729-1
 Cylinder Number: CC349203 Cylinder Volume: 144.4 CF
 Laboratory: ASG - Chicago - IL Cylinder Pressure: 2015 PSIG
 PGVP Number: B12016 Valve Outlet: 350
 Gas Code: PPN,BALN Certification Date: Mar 21, 2016

Expiration Date: Mar 21, 2024

Certification performed in accordance with "EPA Traceability Protocol for Assay and Certification of Gaseous Calibration Standards (May 2012)" document EPA 600/R-12/531, using the assay procedures listed. Analytical Methodology does not require correction for analytical interference. This cylinder has a total analytical uncertainty as stated below with a confidence level of 95%. There are no significant impurities which affect the use of this calibration mixture. All concentrations are on a volume/volume basis unless otherwise noted.
 Do Not Use This Cylinder below 100 psig, i.e. 0.7 megapascals.

ANALYTICAL RESULTS					
Component	Requested Concentration	Actual Concentration	Protocol Method	Total Relative Uncertainty	Assay Dates
PROPANE	500.0 PPM	506.3 PPM	G1	+/- 1.1% NIST Traceable	03/21/2016
NITROGEN	Balance				
CALIBRATION STANDARDS					
Type	Lot ID	Cylinder No	Concentration	Uncertainty	Expiration Date
NTRM	10060532	CC281503	495.3 PPM PROPANE/AIR	+/- 0.5%	Jan 06, 2022
ANALYTICAL EQUIPMENT					
Instrument/Make/Model	Analytical Principle			Last Multipoint Calibration	
Nicolet 6700 AHR0801332	FTIR			Feb 28, 2016	

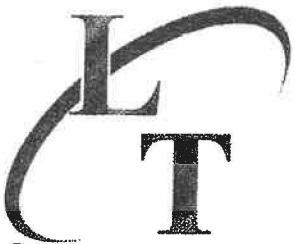
Triad Data Available Upon Request



Approved for Release

Page 1 of 54-124545729-1

G10000243



LIQUID TECHNOLOGY CORPORATION
"INDUSTRY LEADER IN SPECIALTY GASES"

Certificate of Analysis
- EPA PROTOCOL GAS -

Customer Stack Test Group (Ottawa, IL)
Date April 30, 2014
Delivery Receipt DR-51311
Gas Standard 300 ppm Propane/Nitrogen - EPA PROTOCOL
Final Analysis Date April 28, 2014
Expiration Date April 28, 2022

Component Propane
Balance Gas Air

Analytical Data:

EPA Protocol, Section No. 2.2, Procedure G-1

DO NOT USE BELOW 100 psig

Reported Concentrations
Propane: 305 ppm +/- 1.0 ppm
Nitrogen: Balance

Reference Standards:

SRM/GMIS:	GMIS	GMIS
Cylinder Number:	CC-231424	CC-125618
Concentration:	106.42 ppm Propane/Nitrogen	497.23 ppm Propane/Nitrogen
Expiration Date:	04/09/20	04/09/20

Certification Instrumentation

Component:	Propane
Make/Model:	Agilent 7890A
Serial Number:	CN10736166
Principal of Measurement:	GC-FID
Last Calibration:	April 09, 2014

Cylinder Data

Cylinder Serial Number:	EB-0050476	Cylinder Outlet:	CGA 350
Cylinder Volume:	140 Cubic Feet	Cylinder Pressure:	2000 psig, 70°F

Analytical Uncertainty and NIST Traceability are in compliance with EPA-600/R-12/531.

Certified by:

Cole Dylewski

PGVP Vendor ID: E12014

"UNMATCHED EXCELLENCE"

2048 APEX COURT APOPKA, FLORIDA 32703 ~ PHONE (407)292-2990 FAX (407)292-3313
WWW.LIQUIDTECHCORP.COM
APOPKA, FL • HOUSTON, TX

G10000244



Certificate of Analysis

Certificate Number: 3034A-07T5-C01
Certification Date: 4 November 2014
Mixture Grade: EPA Protocol Standard Gas Mixture
Cylinder Number: CC454471

Mixture Components	Requested Composition	Certified Composition	U (Expanded Uncertainty, k=2)
Propane	8500 PPM	8497 PPM	+/- 55 PPM (absolute)
Nitrogen	Balance	Balance	

Cylinder Pressure: 1900 psi – Do not use below 100 psi (0.7 megapascals)
Lot Number: 3034A-07T5
CGA Outlet Conn.: 350
UN Number: UN 1956
Classification: Compressed Gas, n. o. s.
Certification Expiration Date: 4 November 2022
Procedure Used: EPA Traceability Protocol for Gaseous Calibration Standards
Procedure G1, EPA/600/R-12/531 May 2012
Analytical Method: FTIR
Multipoint Calibration Date: 17 October 2014
Production Lab: Tier 5 Labs, LLC, Naperville, IL, PGVP Vendor ID R12014

Reference Standards:
NIST SRM Number 2647a
NIST Sample Number 104-C-44
Cylinder Identification Number XF002995B
Certified Concentration 2467 $\mu\text{mol/mol}$
Expanded Uncertainty +/- 13 $\mu\text{mol/mol}$
Certification Expiration 6-May-17

The calibration results published in this certificate were obtained using equipment and standards capable of producing results that are traceable to National Institute of Standards and Technology (NIST) and through NIST to the International System of Units (SI). The expanded uncertainties, if included on this certificate, use a coverage factor of k=2 to approximate the 95% confidence level of the measurement, unless otherwise noted. If uncertainties are not included on this certificate, they are available upon request. This calibration certificate applies only to the item described and shall not be reproduced other than in full, without written approval from the calibration facility. Calibration certificates without signatures are not valid. This calibration meets the requirements of ISO/IEC 17025-2005.

Steve Tarrant

Weldstar Aurora
1750 Mitchell Road, PO Box 1150
Aurora, IL 60505
Phone 630.859.3100
Fax 630.859.3199

Weldstar Logansport
1000 E. Main Street
Logansport, IN 46947
Phone 574.722.1177
Fax 574.753.3113

Weldstar University Park
1100 Hamilton Avenue
University Park, IL 60484
Phone 708.534.8561
Fax 708.534.7819

CERTIFICATE OF ANALYSIS

Grade of Product: EPA Protocol

Part Number:	E02NI99E15A0561	Reference Number:	54-401002568-1
Cylinder Number:	CC175226	Cylinder Volume:	144.7 CF
Laboratory:	124 - Chicago (SAP) - IL	Cylinder Pressure:	2015 PSIG
PGVP Number:	B12017	Valve Outlet:	350
Gas Code:	PPN,BALN	Certification Date:	Sep 20, 2017

Expiration Date: Sep 20, 2025

Certification performed in accordance with "EPA Traceability Protocol for Assay and Certification of Gaseous Calibration Standards (May 2012)" document EPA 600/R-12/531, using the assay procedures listed. Analytical Methodology does not require correction for analytical interference. This cylinder has a total analytical uncertainty as stated below with a confidence level of 95%. There are no significant impurities which affect the use of this calibration mixture. All concentrations are on a volume/volume basis unless otherwise noted.

Do Not Use This Cylinder below 100 psig, i.e. 0.7 megapascals.

ANALYTICAL RESULTS

Component	Requested Concentration	Actual Concentration	Protocol Method	Total Relative Uncertainty	Assay Dates
PROPANE	5000 PPM	4988 PPM	G1	+/- 0.6% NIST Traceable	09/20/2017
NITROGEN	Balance				

CALIBRATION STANDARDS

Type	Lot ID	Cylinder No	Concentration	Uncertainty	Expiration Date
NTRM	12061208	CC357634	5026 PPM PROPANE/NITROGEN	+/- 0.6%	Jan 20, 2018

ANALYTICAL EQUIPMENT

Instrument/Make/Model	Analytical Principle	Last Multipoint Calibration
Nicolet 6700 AHR0801332	FTIR	Aug 21, 2017

Triad Data Available Upon Request



Alan Canning

Approved for Release

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G10000246



Certificate of Analysis

Certificate Number: 3034A-06T5-C01
Certification Date: 4 November 2014
Mixture Grade: EPA Protocol Standard Gas Mixture
Cylinder Number: CC451707

Mixture Components	Requested Composition	Certified Composition	U (Expanded Uncertainty, k=2)
Propane	3000 PPM	2976 PPM	+/- 35 PPM (absolute)
Nitrogen	Balance	Balance	

Cylinder Pressure: 1900 psi – Do not use below 100 psi (0.7 megapascals)
Lot Number: 3034A-06T5
CGA Outlet Conn.: 350
UN Number: UN 1956
Classification: Compressed Gas, n. o. s.
Certification Expiration Date: 4 November 2022
Procedure Used: EPA Traceability Protocol for Gaseous Calibration Standards
Procedure G1, EPA/600/R-12/531 May 2012
Analytical Method: FTIR
Multipoint Calibration Date: 17 October 2014
Production Lab: Tier 5 Labs, LLC, Naperville, IL, PGVP Vendor ID R12014

Reference Standards:

NIST SRM Number	2647a
NIST Sample Number	104-C-44
Cylinder Identification Number	XF002995B
Certified Concentration	2467 $\mu\text{mol/mol}$
Expanded Uncertainty	+/- 13 $\mu\text{mol/mol}$
Certification Expiration	6-May-17

The calibration results published in this certificate were obtained using equipment and standards capable of producing results that are traceable to National Institute of Standards and Technology (NIST) and through NIST to the International System of Units (SI). The expanded uncertainties, if included on this certificate, use a coverage factor of k=2 to approximate the 95% confidence level of the measurement, unless otherwise noted. If uncertainties are not included on this certificate, they are available upon request. This calibration certificate applies only to the item described and shall not be reproduced other than in full, without written approval from the calibration facility. Calibration certificates without signatures are not valid. This calibration meets the requirements of ISO/IEC 17025-2005.

Steve Tarrant

Weldstar Aurora
1750 Mitchell Road, PO Box 1150
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Phone 630.859.3100
Fax 630.859.3199

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1100 Hamilton Avenue
University Park, IL 60484
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APPENDIX G
RESPONSE FACTOR DETERMINATION FOR VOC EXEMPT COMPOUNDS

General Iron
Chicago, IL
VOM Testing
Response Factor Testing
6/13/2018

Compound	Bag Concentration	FID Response
Chloromethane		
Trial #1	100 PPM	67.1
Trial #2	100 PPM	67.0
Trial #3	100 PPM	67.0
Avg.		67.0
Freon 22		
Trial #1	100 PPM	47.5
Trial #2	100 PPM	47.7
Trial #3	100 PPM	47.8
Avg.		47.7
Freon 12		
Trial #1	100 PPM	117.6
Trial #2	100 PPM	117.4
Trial #3	100 PPM	117.8
Avg.		117.6
Freon 152A		
Trial #1	100 PPM	114.9
Trial #2	100 PPM	115.0
Trial #3	100 PPM	115.0
Avg.		115.0
Carbon Disulfide		
Trial #1	120 PPM	0.2
Trial #2	120 PPM	0.1
Trial #3	120 PPM	0.3
Avg.		0.2
Freon 134A		
Trial #1	100 PPM	114.8
Trial #2	100 PPM	115.1
Trial #3	100 PPM	115.2
Avg.		115.0
Octamethylcyclotetrasiloxane		
Trial #1	100 PPM	114.8

Trial #2	100 PPM	114.9
Trial #3	100 PPM	114.9
Avg.		114.9

APPENDIX H
LABORATORY REPORT FOR VOC EXEMPT COMPOUNDS

DAT Reports®

Data Summary

GPA 2286

Client: Stack Test Group
Client Project:
DAT Project: 0518042
Date Sampled: 5/25/2018
Date Analyzed: 6/25/2018
Analyst: SM

Client Sample ID	DAT Sample ID	Analyte	Detector	ppm (vol)	ppm as Propane	Q
Run 1	0518042- 1	Methane	FID	3.29	1.10	
		Ethane	FID	0.63	0.42	

ND = Not detected in the sample.

D = Value measured from a dilution.

J=Below the lowest calibration point

**Data Summary
GPA 2286**

Client: Stack Test Group
Client Project:
DAT Project: 0518042
Date Sampled: 5/26/2018
Date Analyzed: 6/25/2018
Analyst: SM

Client Sample ID	DAT Sample ID	Analyte	Detector	ppm (vol)	ppm as Propane	Q
Run 2	0518042- 2	Methane	FID	3.10	1.03	
		Ethane	FID	0.45	0.30	

ND = Not detected in the sample.

D = Value measured from a dilution.

J=Below the lowest calibration point

DAT Reports®

Data Summary

GPA 2286

Client: Stack Test Group
Client Project:
DAT Project: 0518042
Date Sampled: 5/27/2018
Date Analyzed: 6/25/2018
Analyst: SM

Client Sample ID	DAT Sample ID	Analyte	Detector	ppm (vol)	ppm as Propane	Q
Run 3	0518042- 3	Methane	FID	3.40	1.13	
		Ethane	FID	0.46	0.30	

ND = Not detected in the sample.

D = Value measured from a dilution.

J=Below the lowest calibration point

TO-15 Data Summary

Client ID Test 1
Sample Name : 0518042-1 1.0mL
Date Acquired : 05/31/18 16:40
Method File : TO151805
Data File Path : C:\HPCHEM\1\DATA\0518042\
Data File Name : 05318R01.D
Sample Multiplier : 200
Dilution factor : 1

Name	Amount (ppb)	PQL (ppb)	MDL (ppb)	Q
Dichlorodifluoromethane	882.72	250.00	22.80	
Chloromethane	ND	250.00	19.80	
1,2-dichlorotetrafluoroethane	ND	250.00	19.20	
Acetone	2714.54	250.00	22.00	
Trichlorofluoromethane	2003.48	250.00	23.40	
Methylene Chloride	221.01	250.00	177.40	
1,1,2-Trichlorotrifluoroethane	ND	250.00	20.80	
1,1,1-Trichloroethane	ND	250.00	21.60	
Tetrachloroethylene	ND	250.00	25.40	
Surrogate %R	%R			
4-bromofluorobenzene	83.26			

ND= Not Detected at the Method Detection Limit.

PQL=Practical Quantitation Limit

MDL= Method Detection Limit

DAT Reports®

Tentatively Identified Compound (LSC) summary

Operator ID: CSM Date Acquired: 31 May 18 4:40 pm

Data File: C:\HPCHEM\1\DATA\0518042\05318R01.D

Name: 0518042-1 1.0mL

Misc: Test 1

Method: C:\HPCHEM\1\METHODS\TO151812.M (Chemstation Integrator)

Title: TO-15

Library Searched: C:\DATABASE\NBS75K.L

TIC Top Hit name	RT	EstConc	Units
Methane, chlorodifluoro-	4.53	8336.8	ppb
Cyclotetrasiloxane, octamethyl-	20.34	2142.2	ppb

RT=Retention time (minutes)

DAT Reports®

TO-15 Data Summary

Client ID : Test #2
Sample Name : 0518042-2 1.0 mL
Date Acquired : 06/ 8/18 15:57
Method File : TO151805
Data File Path : C:\HPCHEM\1\DATA\0518042F\
Data File Name : 06088R03.D
Sample Multiplier : 200
Dilution factor : 1

Name	Amount (ppb)	PQL (ppb)	MDL (ppb)	Q
Dichlorodifluoromethane	406.2	250	22.8	
Chloromethane	ND	250	19.8	
1,2-dichlorotetrafluoroethane	ND	250.00	19.20	
Acetone	14729.93	250.00	22.00	
Trichlorofluoromethane	10211.55	250.00	23.40	
Methylene Chloride	ND	250.00	177.40	
1,1,2-Trichlorotrifluoroethane	ND	250.00	20.80	
1,1,1-Trichloroethane	ND	250.00	21.60	
Tetrachloroethylene	ND	250.00	25.40	
Surrogate %R	%R			
4-bromofluorobenzene	100.9			

ND= Not Detected at the Method Detection Limit.

PQL=Practical Quantitation Limit

MDL= Method Detection Limit

DAT Reports®

Tentatively Identified Compound (LSC) summary

Operator ID: Date Acquired: 8 Jun 18 3:57 pm

Data File: C:\HPCHEM\1\DATA\0518042F\06088R03.D

Name: 0518042-2 1.0 mL

Misc: Test #2

Method: C:\HPCHEM\1\METHODS\TO151812.M (Chemstation Integrator)

Title: TO-15

Library Searched: C:\DATABASE\NBS75K.L

TIC Top Hit name	RT	EstConc	Units
Methane, chlorodifluoro-	4.47	2831.2	ppb
Ethane, 1,1-difluoro-	4.89	3844.5	ppb

DAT Reports[®]

TO-15 Data Summary

Client ID : Test #3
Sample Name : 0518042-3 1.0 mL
Date Acquired : 06/ 8/18 15:14
Method File : TO151805
Data File Path : C:\HPCHEM\1\DATA\0518042F\
Data File Name : 06088R02.D
Sample Multiplier : 200
Dilution factor : 1

Name	Amount (ppb)	PQL (ppb)	MDL (ppb)	Q
Dichlorodifluoromethane	890.44	250.00	22.80	
Chloromethane	ND	250.00	19.80	
1,2-dichlorotetrafluoroethane	ND	250.00	19.20	
Acetone	29905.85	250.00	22.00	
Trichlorofluoromethane	5978.77	250.00	23.40	
Methylene Chloride	ND	250.00	177.40	
1,1,2-Trichlorotrifluoroethane	ND	250.00	20.80	
1,1,1-Trichloroethane	ND	250.00	21.60	
Tetrachloroethylene	42.35	250.00	25.40	
Surrogate %R	%R			
4-bromofluorobenzene	106.4			

ND= Not Detected at the Method Detection Limit.

PQL=Practical Quantitation Limit

MDL= Method Detection Limit

DAT Reports®

Tentatively Identified Compound (LSC) summary

Operator ID: Date Acquired: 8 Jun 18 3:14 pm

Data File: C:\HPCHEM\1\DATA\0518042F\06088R02.D

Name: 0518042-3 1.0 mL

Misc: Test #3

Method: C:\HPCHEM\1\METHODS\TO151812.M (Chemstation Integrator)

Title: TO-15

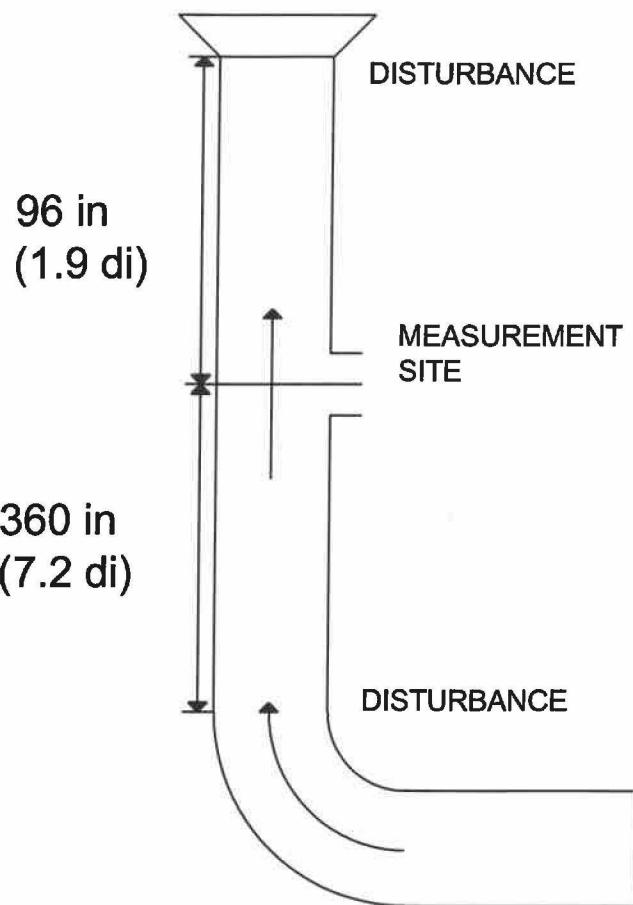
Library Searched: C:\DATABASE\NBS75K.L

TIC Top Hit name	RT	EstConc	Units
Ethane, 1,1-difluoro-	4.89	1560.6	ppb

APPENDIX I
LOCATION OF SAMPLING PORTS & POINTS

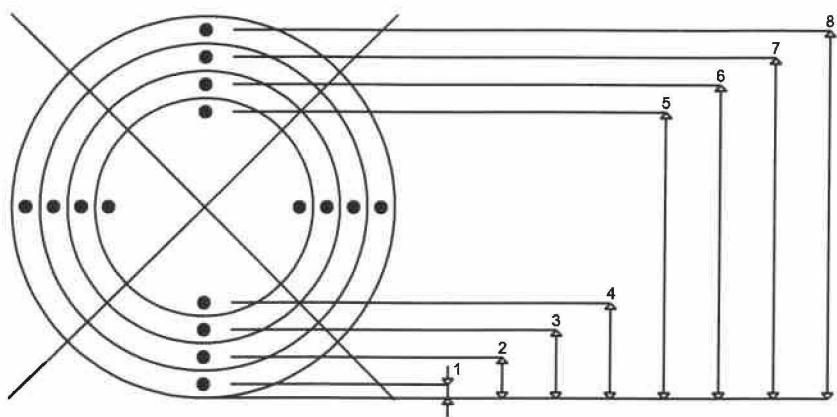
General Iron
Shredder Exhaust

Diameter of Stack = 50 in



Location of Sample Ports

Traverse Point	% of diameter Distance	Distance form Stack Wall (in)
1	.032	1.6
2	.105	5.25
3	.194	9.7
4	.323	16.15
5	.677	33.85
6	.806	40.3
7	.895	44.75
8	.968	48.4



Location of Sample Points

Method 25A

